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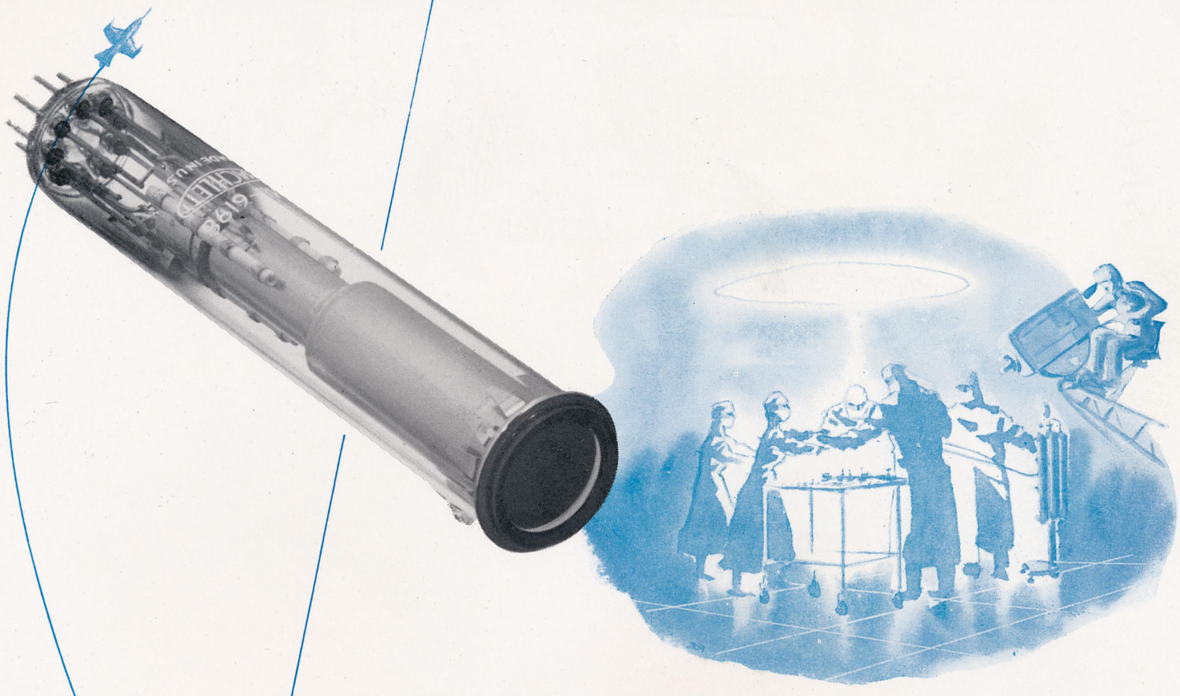

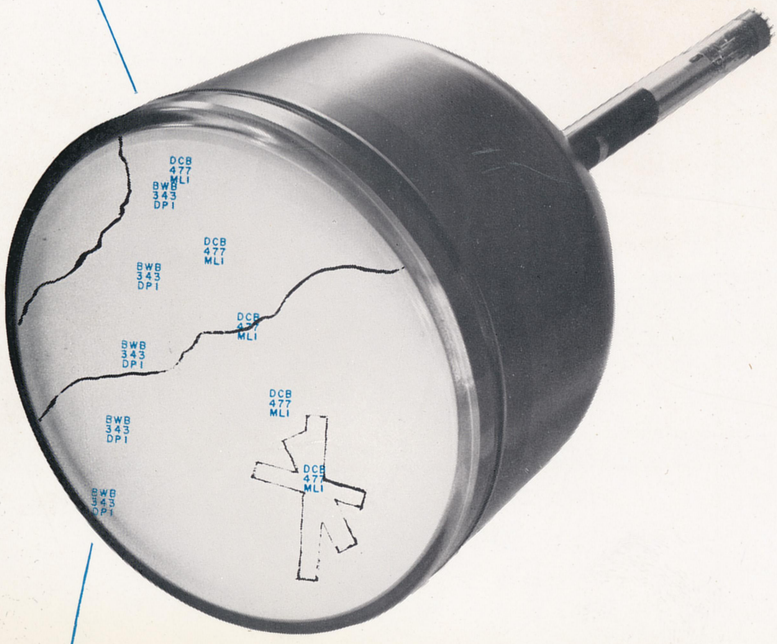

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The Display and Storage Tube Section

At the present time two types of display tubes are manufactured in this section: The "Scriptron," a 19-inch diameter shaped beam character writing tube and the "Storage Scriptron," a 5-inch diameter shaped beam direct viewing storage tube. Other types of display and storage tubes are in the preproduction stage.

These tubes have application in computer readout as well as in position and situation display in air traffic control systems. Both are presently used in SAGE (Semi-Automatic Ground Environment Control) for continental air defense. The production facilities in this section will be used for the manufacture of other types of tubes for air traffic control in the very near future.

Compared to conventional display tubes, such as in a television receiver, the manufacture of these types entails a great number of special techniques. These are highly specialized tubes with rigid performance specifications and their manufacture necessitates a strict and continuous quality control on each part and assembly process. These tubes have life and reliability requirements far exceeding conventional types.

The care taken in fabricating and processing the individual components is therefore the most painstaking possible in the present state of the tube making art. It includes ultrasonic cleaning as well as a number of other super clean techniques such as the assembly of tube parts under dust-free hoods shown in Figure 15.

The C19K Scriptron

This shaped beam display tube 44 inches long, can present information in the form of alphanumeric and symbolic characters at a rate of 25,000 per second. Depending on the system in which the tube is utilized, it displays coded information such as Morse Code or, in its most widely used application in the SAGE computer, the pertinent information on a number of targets or objects, either stationary or moving, in a given area is shown. A map outline of this area is drawn on the faceplate of the tube and the information supplied by the computer is projected into the various

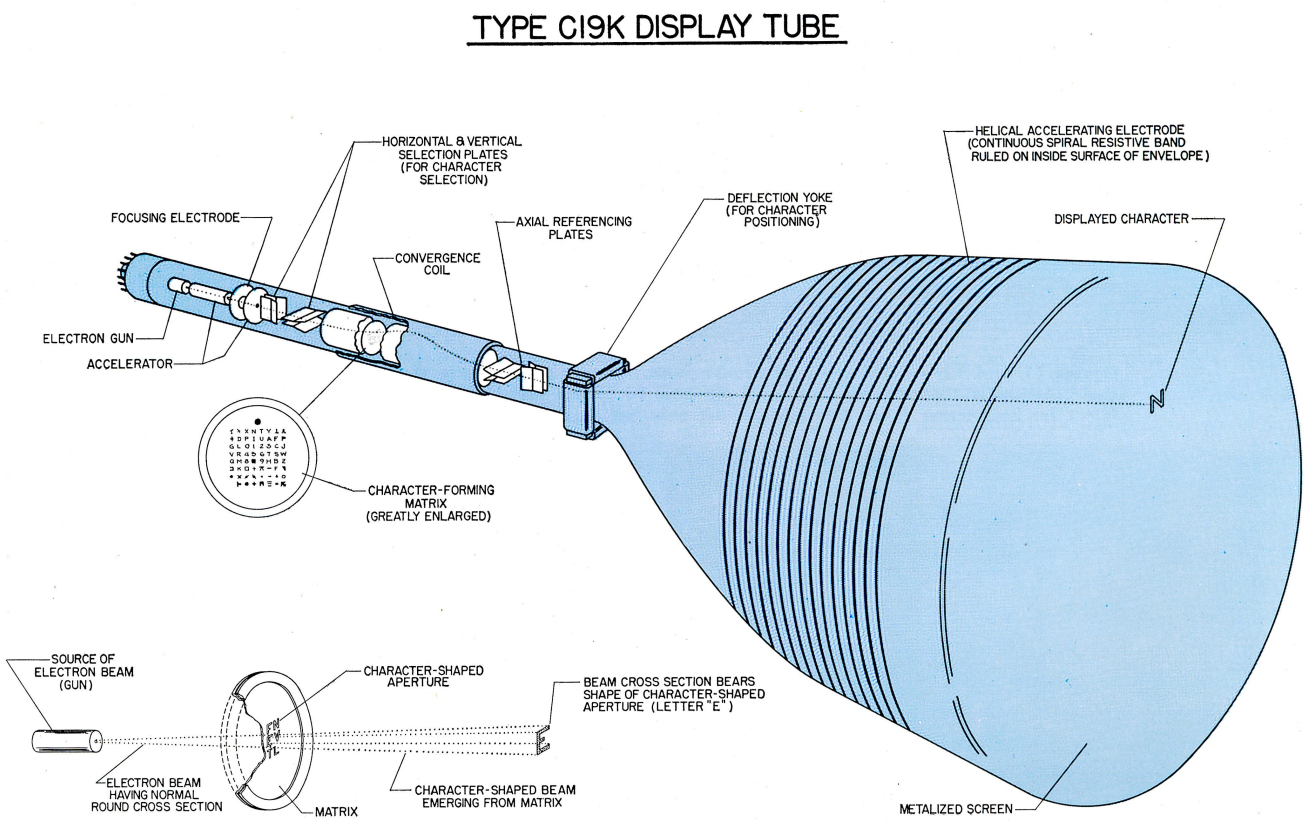

Figure 13 — Basic operation of the ML-C19K "Scriptron". The relatively broad electron beam is directed toward one of the 64 alphanumeric characters by the first set of deflection plates. The so formed electron beam is then brought back to the axis of the tube by a convergence coil and a second set of plates. A magnetic deflection coil subsequently controls the area on which the letter just formed is to be projected. A resistive helix across 12,000 volts supplies the post deflection acceleration.

Figure 14—Gun Assembly operation for the ML-C19K and ML-6577. Air is introduced from left into the top of each sterile shield to eliminate the possibility of contamination or dust infiltration.

Figure 15—Inscription of post deflection acceleration helix into the bulb of the ML-C19K.

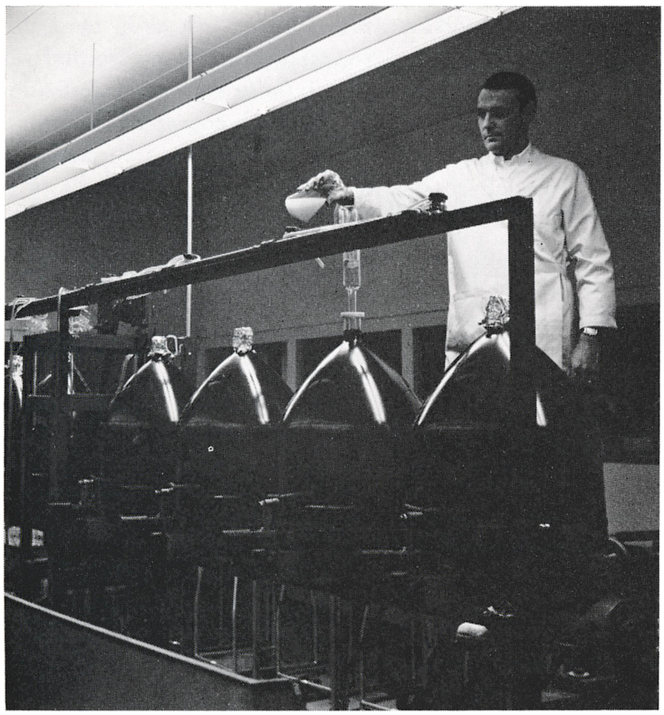

Figure 16—Screen depositing unit showing operator pouring measured amount of phosphor into glass bulbs which are partly filled with distilled water. After phosphor is distributed evenly over the water surface the tubes are tilted and the phosphor adheres to the viewing surface.

Figure 17 — Sealing in the gun assembly into the "Scriptron."

Figure 18 — Collector mesh evaporation unit for the ML-6577 "Storage Scriptron."

geographical locations in this map.

The basic construction of the Scriptron is demonstrated in Figure 13. The mode of operation is as follows. A fairly broad electron beam is produced and accelerated in the standard fashion. A set of selection plates directs the beam to one of the 64 stencil-like openings of the beam shaping matrix. This matrix can comprise any combination of letters, numbers or symbols. In general, the character height is .012″ with a line width of .001″. This shaped beam is then redirected along the axis of the tube by means of a magnetic convergence coil and a set of compensation plates. A magnetic deflection yoke then directs the beam toward the selected part of the 19-inch phosphor viewing screen, where the displayed character height is .115″. Post-deflection acceleration is supplied by means of a spiral electrode which is applied on the inside of the glass envelope as shown in Figure 15 and which has a total resistance of approximately 100 megohms. Very linear deflection sensitivity is obtained by this means.

The ML-6577 Storage Scriptron

This shaped beam storage display tube can both present and retain information in the form of alphanumeric or symbolic characters. This tube has a built-in memory or storage device and thus, in addition to the writing gun, which produces a shaped beam of high energy electrons for writing information on the storage device, it incorporates a "flood" or "reading" gun which produces low velocity electrons for displaying this stored information. The 5-inch viewing surface is usually a P1 phosphor behind which the "storage grid" is mounted.

The mode of operation of this tube is as follows: The shaped electron beam strikes the storage target with a velocity above the first "cross-over" point of secondary electron emission and charges that area to a positive potential. Low velocity electrons produced by the reading gun can pass through the written areas but are blocked by the negative potential of the unwritten areas. The electrons which pass are accelerated and strike the viewing screen and thus present the electrostatically stored information. The manufacture of the storage grid is shown in Figure 18.

This is basically a "bi-stable" tube with infinite storage once letters or symbols have been written and as long as the necessary operating voltages are supplied to the tube. The flood gun also serves as a holding device. Low velocity flood electrons striking the unwritten area tend to hold that area negative while those accelerated electrons striking the positively written areas produce secondary electrons that maintain the written area at a positive potential. Erasing is accomplished by momentarily lowering the collector electrode voltage. The actual character storage is accomplished by means of dielectric material a few thousandths of an inch thick coated on a supporting metal mesh.

The matrix contains any combination of alphanumeric symbols, arranged in an 8 x 8 array, just as in the C19K tube. Writing speeds of 25,000 characters per second can be obtained and due to the infinite storage, information can be obtained without haste or photographic recording.

The tubes described in the preceding are forerunners of lines of specialized electron tubes that will be produced in this new division. While some tubes will be improved versions of existing designs, others will be the result of continuous research and development work carried out at Machlett Laboratories.